

CLAIMS

1. A plasma doping method comprising:

generating mixed plasma of a mixed substance made of a first
5 substance containing impurity to be doped and a second substance having
higher ionization energy than the first substance;

wherein an amount of the second substance is larger than that of
the first substance, the first substance is B_2H_6 , the second substance is rare gas,
and a concentration of B_2H_6 in the mixed substance is below 0.05%.

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2. A plasma doping method comprising:

generating mixed plasma of a mixed substance made of a first
substance containing impurity to be doped and a second substance having
higher ionization energy than the first substance;

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wherein an amount of the second substance is larger than that of
the first substance, the first substance is B_2H_6 , the second substance is rare gas,
a concentration of B_2H_6 in the mixed substance is below 0.5%, and a helicon
plasma source is used as a plasma source.

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3. A plasma doping method comprising:

generating mixed plasma of a mixed substance made of a first
substance containing impurity to be doped and a second substance having
higher ionization energy than the first substance;

wherein an amount of the second substance is larger than that of the first substance, and the step of generating plasma is generating the plasma with ion current density of 1.1 mA/cm^2 or higher.

5 4. A plasma doping method comprising:

generating mixed plasma of a mixed substance made of a first substance containing impurity to be doped and a second substance having higher ionization energy than the first substance;

10 wherein an amount of the second substance is larger than that of the first substance, and the step of generating plasma is generating the plasma with electron temperature of 6.0 eV or higher.

15 5. The plasma doping method as defined in one of Claims 1 and 2, wherein the plasma with ion current density of 1.1 mA/cm^2 or higher is used for doping a target.

6. The plasma doping method as defined in one of Claims 1 and 2, wherein the rare gas is He.

20 7. The plasma doping method as defined in one of Claims 1 and 2, wherein the plasma with electron temperature of 6.0 eV or higher is used for doping a target.

8. The plasma doping method as defined in one of Claims 1 to 4, wherein a dose of impurity on a target is controllable by changing application time of bias voltage.

5 9. The plasma doping method as defined in Claim 8, wherein the bias voltage is -60 V or less.

10 10. The plasma doping method as defined in Claim 1 comprising a preliminary step before the step of generating mixed plasma, the preliminary step being generating plasma of a third substance having smaller ionization energy than the first substance, and the preliminary step and the step of generating mixed plasma being consecutive.

15 11. The plasma doping method as defined in one of Claims 3 and 4, wherein the first substance is selected from at least one of B_2H_6 , BF_3 and $B_{10}H_{14}$, and the second substance is selected from at least one of He, Ne, Rn, Ar, H, N, O, Kr, Xe, Cl, H_2 , NO, N_2 , O_2 , CO, CO_2 , H_2O , SF_6 , Br_2 and Cl_2 .

20 12. A plasma doping method in which a target is doped using plasma with ion current density of 1.1 mA/cm² or higher.

13. A plasma doping method in which a target is doped using plasma with electron temperature of 6.0 eV or higher.

14. A plasma doping method in which plasma of a substance with smaller ionization energy than that of a substance containing impurity to be doped is first generated and then the substance containing impurity to be doped is generated.

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15. A plasma doping method comprising:

doping using mixed plasma of B_2H_6 and He, the step of doping being executed under a condition centering on $n = 0.04/P$ where the n is a concentration of B_2H_6 in He and the P is a pressure at generating the mixed plasma.

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16. The plasma doping method as defined in Claim 15, wherein the n is between $0.85n$ and $1.25n$ in the step of doping.

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17. The plasma doping method as defined in one of Claims 1, 2, 3, 4 and 12 to 15, wherein the method is applied to a manufacture of electric and electronic devices such as semiconductor devices and liquid crystal panels, and passive electric devices such as capacitors, resistors and coils.